

Appl. No.: 10/657,969
Amdt. dated 02/22/2006
Reply to Office action of 12/20/2005

REMARKS/ARGUMENTS

In the Office Action dated December 20, 2005, Claims 1-19 are pending. Claims 1-4, 6, and 7 are rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 3,282,757 to Brussee. Claims 1-8 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Brussee in view of either U.S. Patent No. 4,854,988 to Voirol, et al. or U.S. Patent No. 5,227,208 to Thongs, Jr. Claims 1-6, 9-12, and 14-19 are rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 5,895,699 to Corbett, et al. in view of U.S. Patent No. 5,897,739 to Forster, et al. Claims 7, 8, and 13 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Corbett, et al. in view of Forster, et al. and further view of any of Brussee, Voirol, or Thongs, Jr. Claims 9-19 are also rejected under 35 U.S.C. § 112, second paragraph.

First, regarding the rejection under § 112, the Office Action notes that the term "the adhesive film" appears to lack antecedent basis in Claim 9. Accordingly, Claim 9 is amended above to correct this informality. Applicant submits that this amendment, which is wholly unrelated to the patentability of the claim, addresses the rejection under § 112, and therefore requests withdrawal of the rejection. The Examiner's careful attention to the application is appreciated.

Turning now to the rejections under § 103(a), Applicant respectfully traverses for the following reasons and requests reconsideration of the claims accordingly.

Claim 1 is directed to an apparatus for layup of a composite structure. The apparatus includes a mandrel that defines a layup surface for receiving the composite structure. The layup surface defines an inner portion, which generally corresponds to a desired contour of the composite structure, and a grip feature that is disposed on the layup surface and extends at least partially around the inner portion. In particular, the grip feature defines a retaining surface that is configured to retain the composite structure in a predetermined configuration during manufacture. For example, as illustrated in Figures 3 and 4 of the application, the mandrel 130 defines a layup surface 132 that defines an inner portion 134 and an outer portion 136, which are separated by a grip feature 140, e.g., a groove disposed in the layup surface 132 that defines a boundary between the inner portion 134 and the outer peripheral portion 136. The inner portion 134 generally corresponds to a desired contour of the composite structure 110. The outer portion 136, which extends outwardly from the inner portion 134, can be used to receive and/or secure

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the edges of the tiedown plies 116, 116a outward of a net trim line 124, where the structure 110 is trimmed after curing. As shown in Figures 3 and 4, the grip feature 140 extends continuously around the inner portion, i.e., such that the inner portion is disposed radially within the boundary defined by the grip feature.

Brussee, on the other hand, is directed to a method of making a filament reinforced pressure vessel, and discloses that a plurality of strands 35 are wound on a distensible bladder 18. End fittings 36, 37 are secured to the bladder, and each end fitting 36, 37 has an outer circumferential groove 38. As shown in Figure 3, binding strands or wires 48 are wrapped around the strands 35 in the groove to secure the strands 35 to the fitting 36, 37.

The Office Action states that Brussee discloses a mandrel and suggests that the end fittings 36, 37 of Brussee are part of a layup surface and that the circumferential groove 38 is a grip feature as claimed. However, the Office Action does not point out any inner portion of a layup surface that generally corresponds to a desired contour, as claimed. Even if the bladder 18 of Brussee could be considered to be a "mandrel" that corresponds to the desired contour, the circumferential groove 38 does not extend "at least partially around" the surface of the bladder, as claimed. That is, the circumferential groove does not even partially encircle or surround the surface of the bladder. Indeed, the surface of the bladder is radially outside the boundary defined by the groove 38. Similarly, each of the other cited references also fails to disclose a grip feature that defines a retaining surface and extends at least partially around an inner portion of a mandrel that corresponds to a desired contour for forming a composite structure. Therefore, Applicant respectfully submits that Claim 1 is allowable over the cited references, as are each of the dependent Claims 2-8.

The dependent claims also provide additional bases of distinction over the cited references. For example, dependent Claim 2 recites that "the grip feature extends continuously around the inner portion of the layup surface." Claim 3 recites that "the retaining surface [which is defined by the grip feature and configured to retain the composite structure in a predetermined configuration during manufacture] is generally perpendicular to the layup surface and defines an edge with the layup surface, the retaining surface and the edge configured to engage the composite structure." For example, as shown in Figure 4 of the present invention, the "retaining surface 142 is generally perpendicular to the layup surface 132 so that the retaining surface 142

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and the layup surface 132 define an edge 144 therebetween." Present application at paragraph 33. Even if the fittings 36, 37 of Brussee are considered to define a retaining surface that is generally perpendicular to the surface of the bladder 18, the fittings 36, 37 do not define an edge with the bladder that is configured to engage the composite structure. Instead, as shown, for example, in Figure 6 of Brussee, the fitting 36 and the bladder 18 define a smooth transition, such that while the strands 35 can be secured in the circumferential groove 38, the strands are not engaged by an edge of the fitting 36. Similarly, the other cited references fail to disclose this feature.

Dependent Claim 7 further recites that "the layup surface defines an outer peripheral portion outward of the inner portion and wherein the grip feature is a grip groove disposed in the layup surface and defining a boundary between the inner portion and the outer peripheral portion of the layup surface." The Office Action has not identified any portion of the device of Brussee that corresponds to the claimed outer peripheral portion. Further, Applicant submits that Brussee does not disclose such this feature. To the contrary, the circumferential groove 38 of Brussee is provided at the end of the bladder, not as a boundary between inner and outer portions of a layup surface as claimed.

Independent Claim 9 stands rejected under the sole basis of being unpatentable over Corbett, et al. in view of Forster, et al. Claim 9 is directed to a method for retaining a composite structure during manufacture. The method includes "providing a mandrel having a layup surface for receiving the composite structure thereon, the layup surface having an inner portion and a grip feature defining a retaining surface extending at least partially around the inner portion." A composite preform is assembled on the layup surface, and at least one tiedown ply of the preform is adhered to the mandrel with a film adhesive applied at the grip feature. The film adhesive has a cure temperature that is lower than a cure temperature of a resin of the laminate.

As described above, none of the cited references discloses a mandrel, as claimed, with a layup surface that has a grip feature defining a retaining surface extending at least partially around an inner portion of the layup surface. In particular, the Office Action notes that Corbett, et al., which is described in the background of the present application, does not describe any grip feature. Forster, et al. discloses that a "perforated or apertured" metal strip 140 can be affixed to a mold member 122, and a peripheral portion 130 of an upper composite skin 126 can be laid

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over the strip 140 "such that under compacting pressure the apertures 142 thereof capture or grip the peripheral portion 130 to prevent lateral displacement of the upper composite skin 126." Col. 2, lines 55-65. The metal strip 140 is similar to the "grip strips" that are described in the background of the present application. In particular, like the grip strips, the metal strip 140 (a) is not part of the mold member 122 and therefore must be secured thereto, (b) adds to the manufacturing cost, and (c) can be difficult to clean after use, requiring additional time for cleaning or replacement. See the present application at paragraph 7. In fact, Forster, et al. specifically teaches away from the use of the metal strip 140, noting that "laborious cleaning is required to remove excess resin from the apertures 142 prior to initiating the next cure cycle." Col. 2, lines 63-65.

In any case, the metal strip 140 is not a grip feature of the mandrel, as claimed. Further, in light of the disclosure of Forster, et al. relating to the difficulty of cleaning, it would not have been obvious to modify a mandrel to define such a grip feature. Further, the metal strip 140 of Forster, et al. does not define any retaining surface that extends "at least partially around the inner portion" of the layup surface. Even if the wall of each aperture in the metal strip is considered to be a retaining surface, the wall does not extend around the inner portion. Instead, each wall extends only around the periphery of the respective aperture. In fact, Forster, et al. does not teach or suggest an elongate grip feature. To the contrary, Forster, et al. teaches away from the use of such grip features altogether. Therefore, even in light of Forster, et al. it would not have been obvious to a person of ordinary skill in the art to modify the teaching of Corbett, et al. to arrive at the claimed invention.

In addition, the method of Claim 9 includes other features that are not taught or suggested by the cited references. In particular, as described above, the method includes adhering at least one tiedown ply of the preform to the mandrel "with a film adhesive applied at the grip feature such that the tiedown ply is retained by the grip feature in a predetermined configuration," the film adhesive having a cure temperature that is lower than a cure temperature of a resin of the laminate. Thus, as described in the present application, the preform can be heated to a first temperature to cure the film adhesive. Then, with the film adhesive cured to secure the preform to the grip feature, the preform is heated to a higher temperature to cure the resin, thereby

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reducing wrinkling, crushing, and/or other undesirable movement of the preform during curing.

With regard to the use of a film adhesive, the Office Action states:

Corbett et al suggested that it was known at the time the invention was made to incorporate a plurality of tiedown plies in the manufacture of a composite structure on a mandrel wherein the composite structure including facing sheets disposed against a honeycomb core. The reference additionally envisioned the use of resin films between the tie down plies in order to retain the tie down plies against the mandrel during processing and to adhere the tie down plies together.

* * *

Regarding the use of a film to hold the tie downs together, the reference to Corbett et al suggested this arrangement. Note that the films described had a lower curing temperature than the remaining composite material employed.

Office Action at pages 4-5.

Applicant respectfully disagrees. Claim 9 recites that the film adhesive is applied at the grip feature to adhere the tiedown ply to the mandrel. Corbett, et al. does not disclose applying a film adhesive at a grip feature and, further, does not disclose adhering a tiedown ply to the mandrel with an adhesive film. Further, Claim 9 recites that the film adhesive has a cure temperature that is lower than the cure temperature of the resin of the laminate, e.g., so that the film adhesive can be cured at a first temperature to secure the preform to the grip feature before the resin is cured. Corbett, et al. specifically teaches away from a "staged cure cycle" that requires stages at different temperatures, noting among other things that "a modified cure cycle increases autoclave processing time. Increased processing time translates to a significant fabrication cost increase with risk of rejection of high value parts at the mercy of uncontrolled and inadequately understood factors." Col. 1, line 61 – col. 2, line 15. Even in the "staged cure cycle" discussed by Corbett, et al., a film adhesive is not used to adhere a tiedown ply to a mandrel at a temperature lower than the cure temperature of a laminate's resin, as claimed. Similarly, the other cited references also fail to teach this feature. In fact, Forster, et al., which is the only other reference cited in connection with Claim 9, specifically teaches away from the provision of resin at the apertures 142 of the metal strip 140, as noted above, citing the "laborious cleaning" that is required to remove excess resin.

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Accordingly, Applicant submits that Claim 9 is allowable over the cited references, as are each of the dependent Claims 10-19.

* * * *

CONCLUSIONS

In view of the remarks presented above, Applicant submits that the present application is in condition for allowance. As such, the issuance of a Notice of Allowance is therefore respectfully requested. In order to expedite the examination of the present application, the Examiner is encouraged to contact Applicant's undersigned attorney in order to resolve any remaining issues.

It is not believed that extensions of time or fees for net addition of claims are required, beyond those that may otherwise be provided for in documents accompanying this paper. However, in the event that additional extensions of time are necessary to allow consideration of this paper, such extensions are hereby petitioned under 37 CFR § 1.136(a), and any fee required therefore (including fees for net addition of claims) is hereby authorized to be charged to Deposit Account No. 16-0605.

Respectfully submitted


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Grace R. Rippey

February 22, 2006

Date